Docket No. MR1035-777

PATENT APPLICATION TRANSMITTAL LETTER

TO THE COMMISSIONER OF PATENTS AND TRADEMARKS:

Transmitted herewith for filing is the Patent Application of
TING KUO CHEN; WEN CHIN KUO; YONG SEN LIAO; CHUN CHIEH LIN

for
SMART AUTOMATIC RECORDING SYSTEM AND METHOD FOR MONITORING WAFER FRAGMENTATION

Enclosed are:

☒ 5 sheets of drawings

☒ an assignment of the invention to
WINBOND ELECTRONICS CORP.

☐ a certified copy of a _____ application

☐ associate power of attorney

☐ a verified statement to ascertain small entity status under 37 CFR § 1.9 & 1.27

CLAIMS AS FILED

	NUMBER FILED	NUMBER EXTRA	RATE	FEE
BASIC FEE			$710	$710
TOTAL CLAIMS	13 -20	0	x 18	0
INDEPENDENT CLAIMS	3 -3	0	x 80	0
MULTIPLE DEPENDENT CLAIM PRESENT			$270	0
NUMBER EXTRA MUST BE ZERO OR LARGER			TOTAL	$710
If applicant is a small entity under 37 CFR 1.22, then reduce fee by 50%			SMALL ENTITY TOTAL	----
ASSIGNMENT			$ 40	40
TOTAL PATENT APPLICATION FEE				$ 750

☒ A check in the amount of $ 750.00 to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. 18-2011 as described below. I have enclosed a duplicate copy of this sheet.

- ☐ Charge the amount of $_____ as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 CFR 1.17
  - ☒ for this filing, and/or
  - ☒ for later presentation of extra claims.
- ☐ Charge any Patent Application processing fees under 37 CFR 1.17
  - ☐ for this filing only, or
  - ☐ during pendency of this Application
- ☐ Charge the issue fee set in 37 CFR 1.18 at or before mailing of the Notice of Allowance, pursuant to 37 CFR 1.317(b).

10/3/2000
Date

Signature

SMART AUTOMATIC RECORDING SYSTEM AND METHOD FOR MONITORING WAFER FRAGMENTATION

Field of the invention

The present invention relates to a smart automatic recording system and method for monitoring wafer fragmentation to facilitate judgement, diagnosis, genuine factor verification, or engineering improvement and management for associated technicians by using photographing devices and a personal computer (PC).

Background of the invention

Because the perspectives of wafer factories are good and their throughputs expand continually, there is an abrupt increase in the equipment quantities and the degree of machine automation. However, the required training of technicians becomes more cumbersome, and it is difficult to reckon with machine anomalies occurring seldom such as wafer fragmentation or malfunction by long-term in-situ monitoring. Therefore, although the CMP Ebara machine has good stability, the problems of wafer fragmentation and wafer dropping due to unknown reasons may still occur.

To effectively inspect the reasons of wafer fragmentation and wafer dropping, the expedient is to perform the machine monitoring. However, the efficiency of using manpower for stationing or a recorder for recording is much unsatisfactory, and it is difficult to circularize and examine the data among many people. Moreover, the storage and management of data will be very bothersome.

Summary and objects of the present invention

Accordingly, the primary object of the present invention is to provide a smart automatic recording system and method for monitoring wafer fragmentation to facilitate judgement, diagnosis, genuine factor verification, or engineering improvement and management for associated technicians.

The secondary object of the present invention is to provide a smart automatic recording system and method for monitoring wafer fragmentation, wherein only the image of a fragmentized wafer and the two images before it will be recorded. Therefore, cheap and convenient factor analysis can be obtained, and the space of the hard disk will not be wasted.

The various objects and advantages of the present invention will be more readily understood from the following detailed description when read in conjunction with the appended drawings, in which:

Brief description of drawing:

Fig. 1 is a diagram showing the actual hardware connection of the present invention;

Fig. 2 is a flowchart of a smart automatic recording method for monitoring wafer fragmentation according to an embodiment of the present invention;

Fig. 3 shows the process to capture, merge, and store the images of wafers;

Fig. 4 shows the process performed by means of IC design and a control card to capture, merge, and store the image of wafers;

Fig. 5 is a flowchart of an automatic monitoring system for burglarproof purpose of house derived and modified from the present invention.

Detailed description of preferred embodiment

As shown in Fig. 1, a smart recording system for monitoring wafer fragmentation according a preferred embodiment of the present invention comprises a plurality of photographing devices 11 such as CCD cameras or general recorders so that the circumstances can be monitored when wafers are polished. The photographed images are then transferred to a multiple-image receiver 13 by a multiple-image transmitter 12. The photographed images are digitized and recorded simultaneously by a plurality of photographing devices. After the multiple-image receiver 13 receives the image signals, the images captured at the same time will be merged into the same image frame 14 by the multiple-image receiver 13. Next, the multiple-image receiver 13 transfers the image signals to the input terminal of an image-capturing card in a PC. The PC also receives the wafer-entry and wafer-exit signals and the signal of wafer fragmentation transferred from the I/O port of a polishing apparatus. A whole monitoring system is thus formed.

Please refer to Fig. 2. Three files Image(1), Image(2), and Image(3) set in the PC are first cleared (Step 21). A wafer-entry signal will be transferred to the PC by the polishing apparatus when a wafer enters the polishing apparatus (Step 22). The PC will issue instructions to the photographing devices to let them start to capture images and store the images into the file Image(3) (Step 23). The wafer will proceed to the polishing position and then leave the polishing apparatus when the polishing work is finished. From the moment when the wafer enters the polishing apparatus to the moment when it leaves the polishing apparatus, the photographing devices photograph and monitor

uninterruptedly, with the photographed images shiftably stored in the three files Image(1), Image(2), and Image(3) in the order of Image(3), Image(2), and Image(1). Speaking more clearly, when a new image is received, the image in Image(2) will be stored in Image(1), the image in Image (3) will be stored in Image(2), and the new image will be stored in Image (3). The photographing devices photograph the polishing process of a wafer until the PC receives a signal of wafer fragmentation or a wafer-exit signal from the polishing apparatus. When the situation of wafer fragmentation occurs (Step 24), an image-capturing system will maintain the status and stop the process (Step 241) so that technicians can analyze the images stored in the three files Image(1), Image(2), and Image(3) to find out the reason of wafer fragmentation easily (Step 242). After the problem has been resolved, the polishing process will be continued. Contrarily, if the polishing process is successful so that the situation of wafer fragmentation does not arise, the file Image(2) will be stored as the file Image(1), the file Image(3) will be stored as the file Image(2), and the file Image(3) will be cleared. The above procedures are repeated until the polishing work of the whole batch of wafers is finished.

Fig. 3 shows the process to capture, merge, and store the images of wafers, which process comprises the steps of:

(1). capturing an image signal by a plurality of photographing devices;

(2). transferring the image signal to an image receiver;

(3). receiving the image signal by the image receiver;

(4). merging the images captured at the same time into the same image frame by the image receiver;

(5). judging whether a wafer enters the polishing apparatus (judging whether the state of the store instruction is "ON");

(6). digitizing the captured image by an image-capturing card in a PC when a wafer enters the polishing apparatus;

(7). storing the digitized image into a file Image(3) set in the PC.

The photographing device used in Step (5) to judge whether a wafer enters the polishing apparatus can be a CCD camera. The judgement can be made according to the signal transferred from the I/O port of the polishing apparatus. After the image-capturing system in Step (4) maintains the status and stops the process, technicians can examine the reason of wafer fragmentation to resolve the problem so that normal polishing process can then be continued.

Fig. 4 shows the process performed by means of IC design and a control card to capture, merge, and store the image of wafers. The functional circuits of the above steps (3) to (7) are combined to form a control card so that a more compact system can be obtained.

Please refer to Fig. 5, wherein the signal from the I/O port is changed to be a break-in signal of a burglar. In other words, the system of present invention can be installed in a house as an automatic monitoring system for burglarproof purpose. Because the principle and procedures are identical to those described above, they will not be further illustrated.

Although the present invention has been described with reference to the preferred embodiments thereof, it will be understood that the invention is not limited to the details thereof. Various substitutions and modifications have been suggested in the foregoing description, and others will occur to those of

ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.

I claim:

1. A smart recording system for monitoring wafer fragmentation, comprising mainly:

a plurality of photographing devices for simultaneously monitoring the circumstances when wafers are polished;

a multiple-image transmitter for transferring the image signals photographed by said photographing devices;

a multiple-image receiver for receiving the image signals transferred from said multiple-image transmitter and then merging the images captured at the same time into the same image frame; and

a personal computer wherein the I/O port of an image-capturing card can receive the image signal transferred from said multiple-image receiver, said PC also being used to receive the signal when a wafer enters or leaves the polishing apparatus and the signal of wafer fragmentation from a signal-transmitting device.

2. The smart recording system for monitoring wafer fragmentation as claimed in claim 1, wherein said photographing devices are CCD cameras.

3. The smart recording system for monitoring wafer fragmentation as claimed in claim 1, wherein said signal-transmitting device is an I/O port.

4. A smart recording method for monitoring wafer fragmentation, comprising mainly the steps of:

(1). clearing three files Image(1), Image(2), and Image(3) set in a personal computer;

(2). judging whether a wafer enters a polishing apparatus; repeating this step

if the answer is negative until a wafer enters the polishing apparatus;

(3). capturing images by a plurality of photographing devices and storing the images in said file Image(3);

(4). judging whether a signal of wafer fragmentation is generated; maintaining the status of an image-capturing system and stopping the process if the answer is positive; continuing the next step otherwise;

(5). continuing to capture images by said photographing devices, judging whether the wafer leaves the polishing apparatus, jumping back to said Step (4) if the answer is negative until the wafer leaves the polishing apparatus;

(6). storing said file Image(2) as said file Image(1), storing said file Image(3) as said file Image(2), clearing said file Image(3); and

(7). repeating said Steps (2) to (6) until the polishing work of the whole batch of wafers is finished.

5. The smart recording method for monitoring wafer fragmentation as claimed in claim 4, wherein said photographing device used in said Step (5) is a CCD camera.

6. The smart recording method for monitoring wafer fragmentation as claimed in claim 4, wherein the judgement in said Step (2) is made according to a wafer-entry signal transferred from an I/O port.

7. The smart recording method for monitoring wafer fragmentation as claimed in claim 4, wherein the judgement in said Step (4) is made according to a wafer-fragmentation signal transferred from an I/O port.

8. The smart recording method for monitoring wafer fragmentation as claimed in claim 4, wherein the judgement in said Step (5) is made according to a

wafer-exit signal transferred from an I/O port.

9. The smart recording method for monitoring wafer fragmentation as claimed in claim 4, wherein after the status of said image-capturing system is maintained and the process is stopped in said Step (4), technicians can examine the circumstances.

10. The smart recording method for monitoring wafer fragmentation as claimed in claim 9, wherein said Step (1) is jumped back to after technicians examine the circumstances.

11. A storing method of wafer images, comprising mainly the steps of:

(1). capturing an image signal by a plurality of photographing devices;

(2). transferring the image signals to an image receiver;

(3). receiving the image signals by said image receiver;

(4). merging the images captured at the same time into the same image frame by said image receiver;

(5). judging whether a wafer enters a polishing apparatus (judging whether the state of the store instruction is "ON");

(6). digitizing the captured image by an image-capturing card in a PC when a wafer enters the polishing apparatus;

(7). storing said digitized image into a file Image(3) set in said PC.

12. The storing method as claimed in claim 11, wherein said photographing devices are CCD cameras.

13. A control card formed by combining the functional circuits for controlling said Steps (3) to (7) in the storing method as claimed in claim 11.

Abstract

The present invention proposes a smart automatic recording system and method for monitoring wafer fragmentation, which system comprises a plurality of photographing devices, a multiple-image transmitter, a multiple-image receiver, and a PC. The photographing devices are used to monitor the circumstances when wafers are polished. The photographed images are then transferred to the multiple-image receiver by the multiple-image transmitter. After the multiple-image receiver receives the image signals, it merges the images captured at the same time into the same image frame. Next, the multiple-image receiver transfers the image signal to the input terminal of an image-capturing card in the PC. The PC also receives the wafer-entry and wafer-exit signals and the signal of wafer fragmentation transferred from the I/O port of the polishing apparatus. The present invention can be exploited to facilitate judgement, diagnosis, genuine factor verification, or engineering improvement and management for associated technicians.

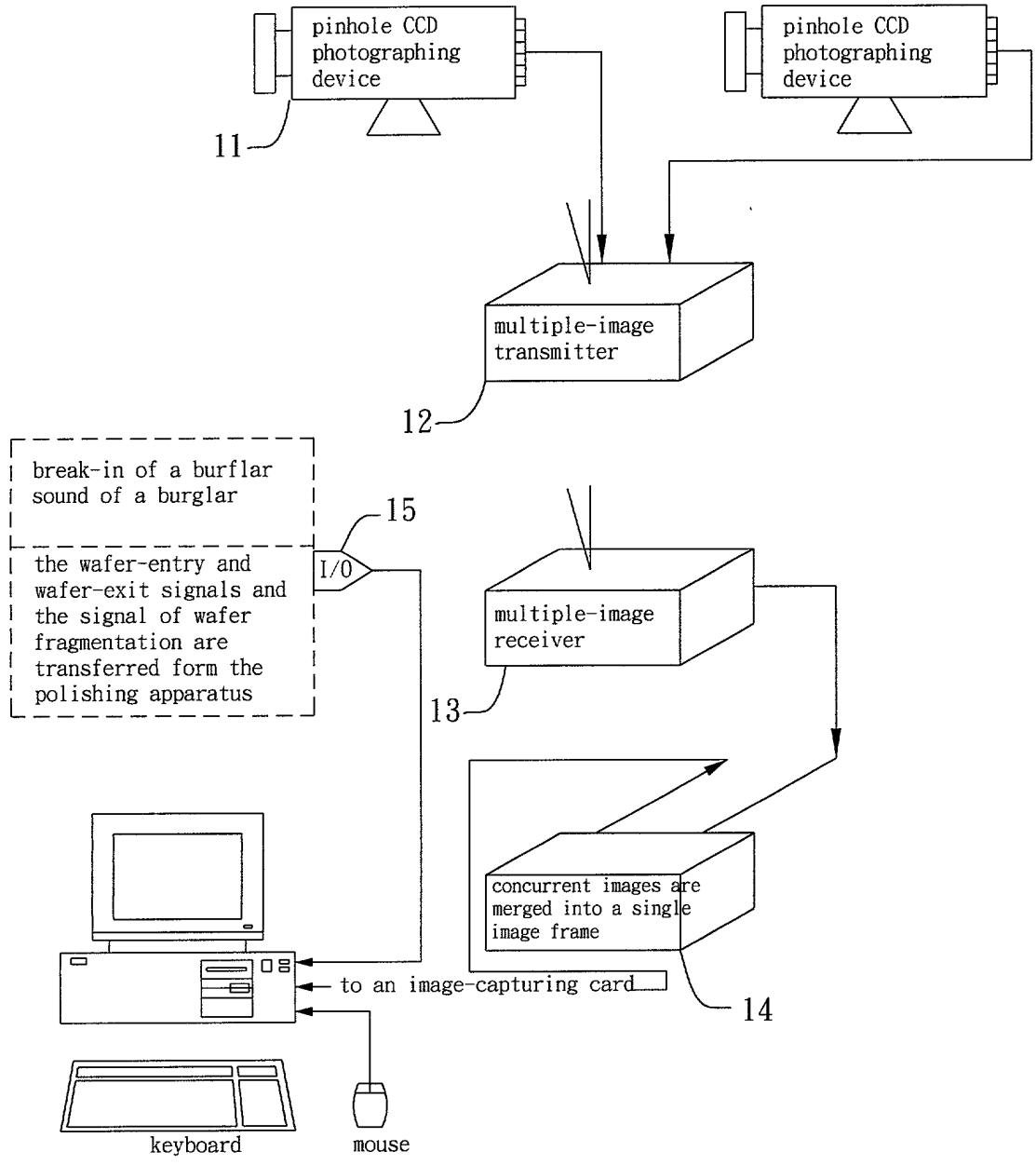
pinhole CCD photographing device
pinhole CCD photographing device
11
multiple-image transmitter
12
break-in of a burflar sound of a burglar
the wafer-entry and wafer-exit signals and the signal of wafer fragmentation are transferred form the polishing apparatus
15
I/O
multiple-image receiver
13
concurrent images are merged into a single image frame
to an image-capturing card
14
keyboard
mouse

Fig. 1

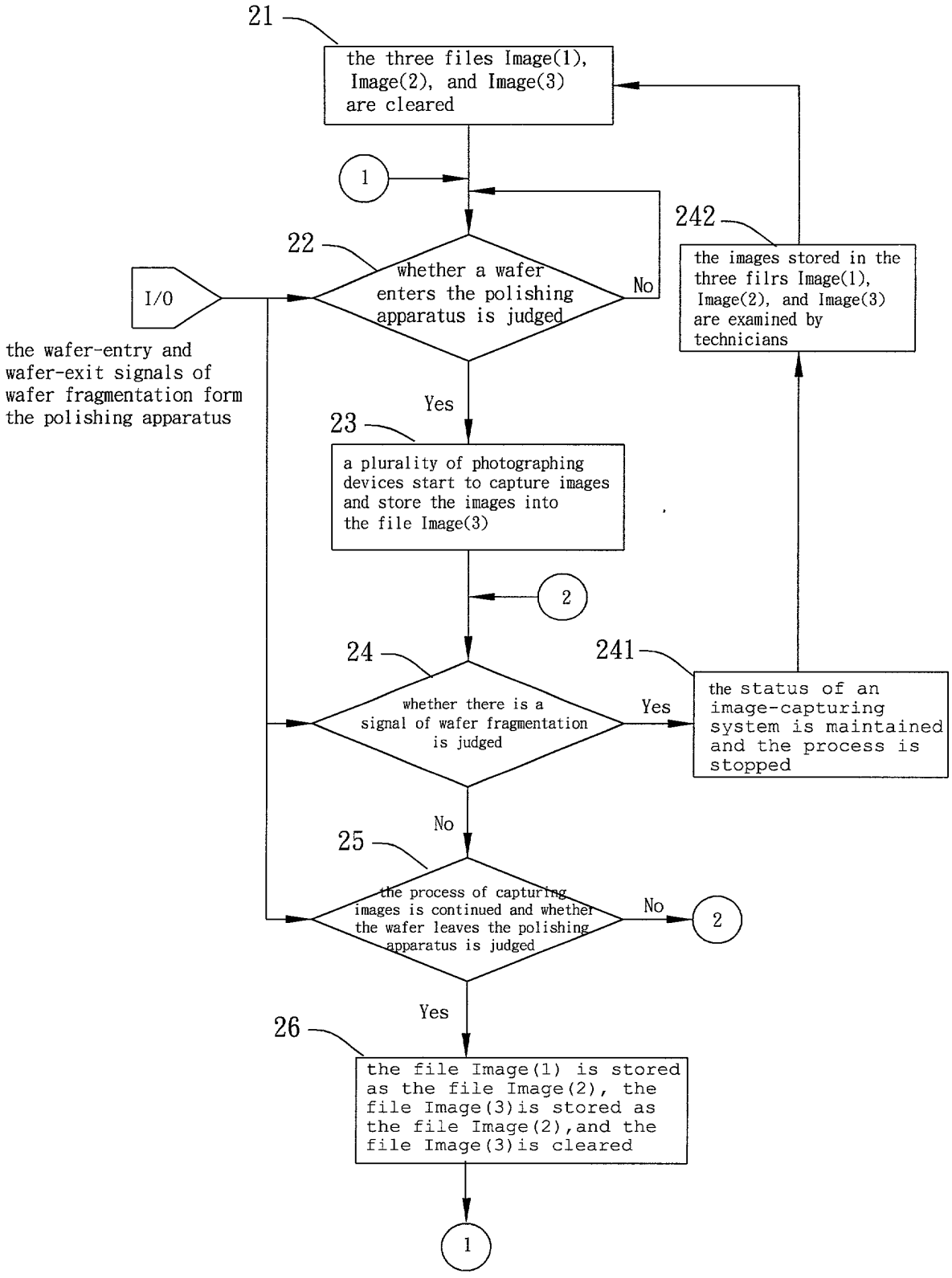
21
the three files Image(1), Image(2), and Image(3) are cleared
1
22
whether a wafer enters the polishing apparatus is judged
No
I/O
the wafer-entry and wafer-exit signals of wafer fragmentation form the polishing apparatus
Yes
23
a plurality of photographing devices start to capture images and store the images into the file Image(3)
2
24
whether there is a signal of wafer fragmentation is judged
Yes
241
the status of an image-capturing system is maintained and the process is stopped
242
the images stored in the three filrs Image(1), Image(2), and Image(3) are examined by technicians
No
25
the process of capturing images is continued and whether the wafer leaves the polishing apparatus is judged
No
2
Yes
26
the file Image(1) is stored as the file Image(2), the file Image(3)is stored as the file Image(2),and the file Image(3)is cleared
1

Fig. 2

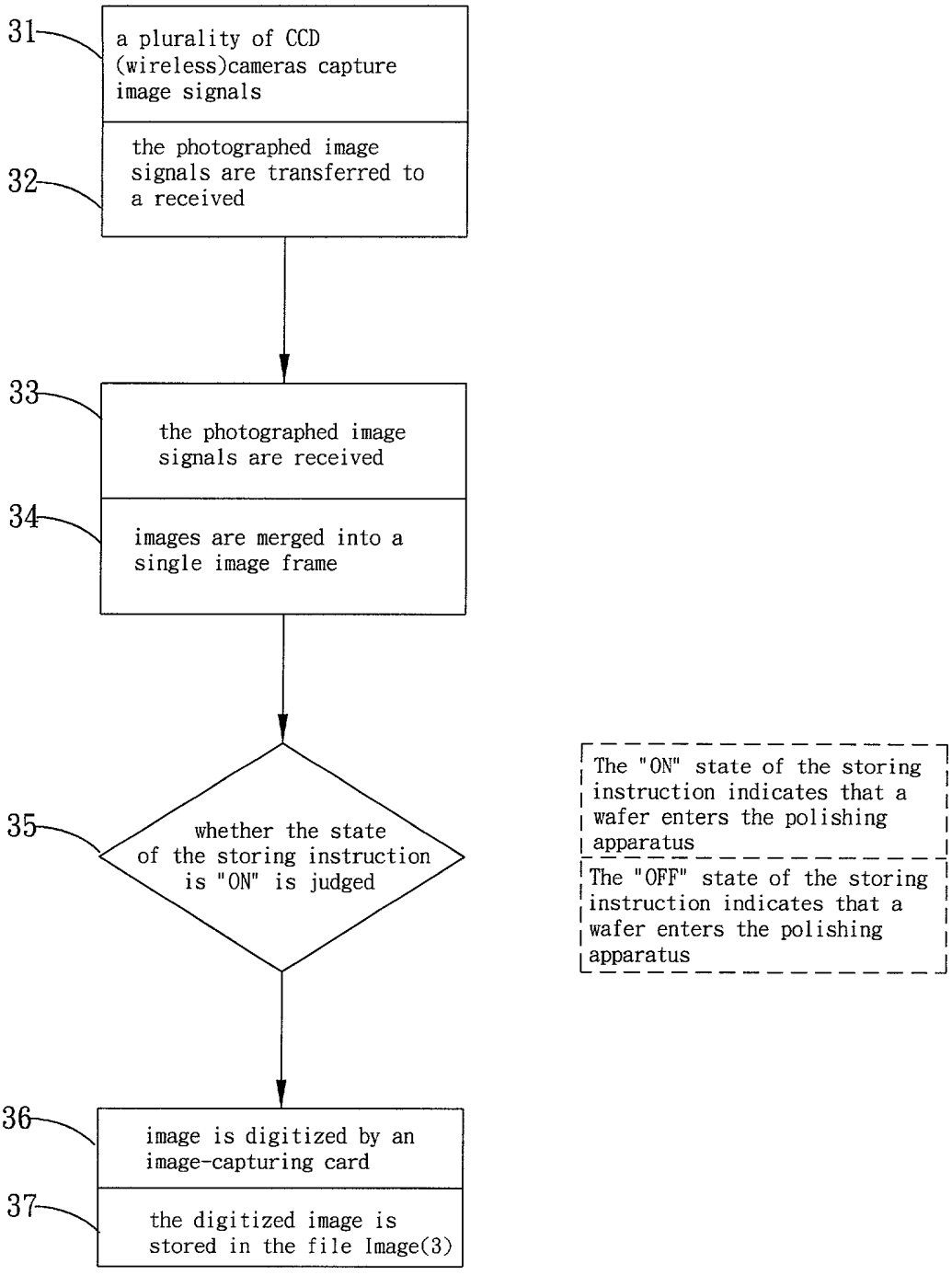
31
a plurality of CCD (wireless)cameras capture image signals
32
the photographed image signals are transferred to a received
33
the photographed image signals are received
34
images are merged into a single image frame
35
whether the state of the storing instruction is "ON" is judged
The "ON" state of the storing instruction indicates that a wafer enters the polishing apparatus
The "OFF" state of the storing instruction indicates that a wafer enters the polishing apparatus
36
image is digitized by an image-capturing card
37
the digitized image is stored in the file Image(3)

Fig. 3

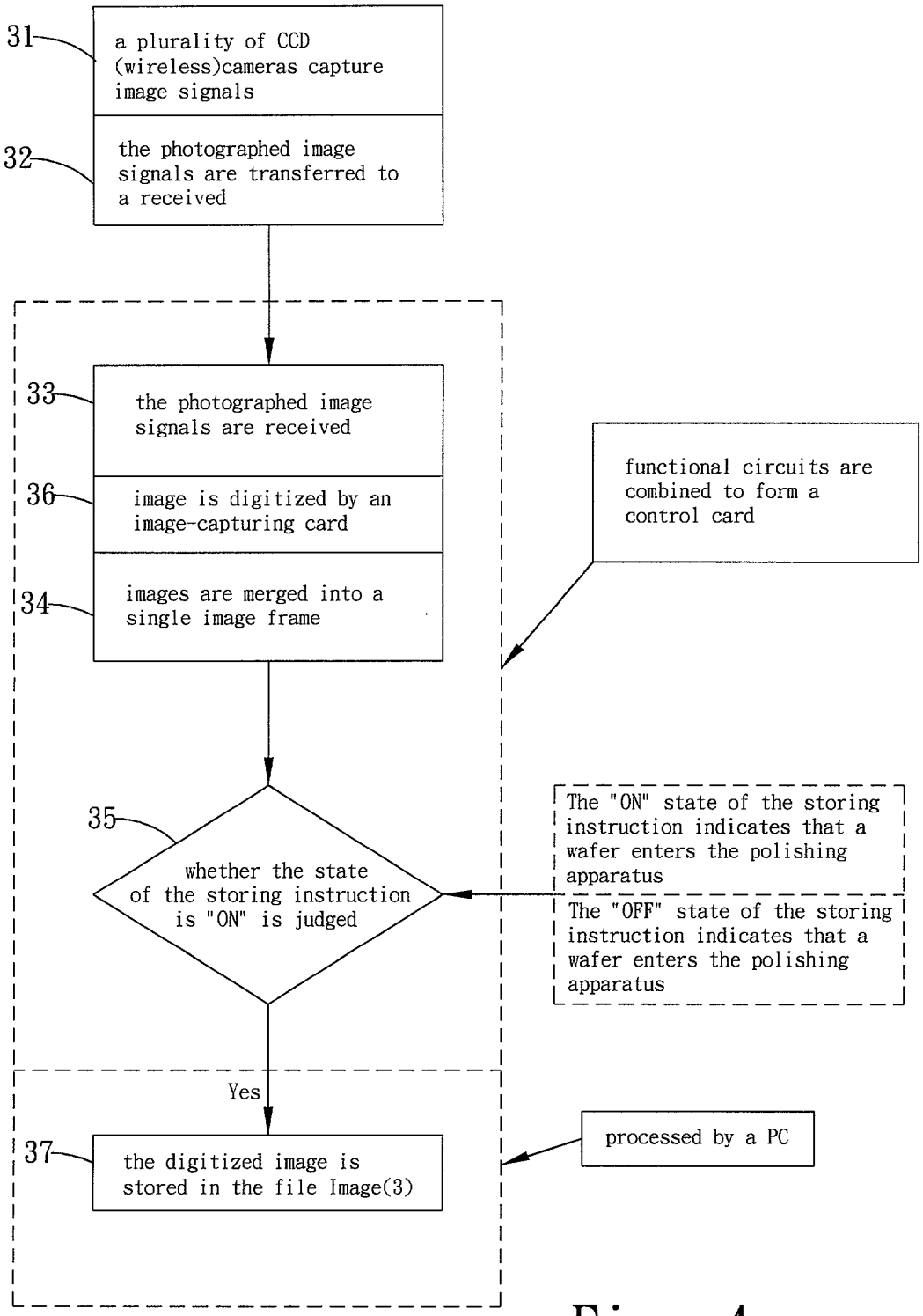
31
a plurality of CCD (wireless)cameras capture image signals
32
the photographed image signals are transferred to a received
33
the photographed image signals are received
36
image is digitized by an image-capturing card
34
images are merged into a single image frame
functional circuits are combined to form a control card
35
whether the state of the storing instruction is "ON" is judged
The "ON" state of the storing instruction indicates that a wafer enters the polishing apparatus
The "OFF" state of the storing instruction indicates that a wafer enters the polishing apparatus
Yes
37
the digitized image is stored in the file Image(3)
processed by a PC

Fig. 4

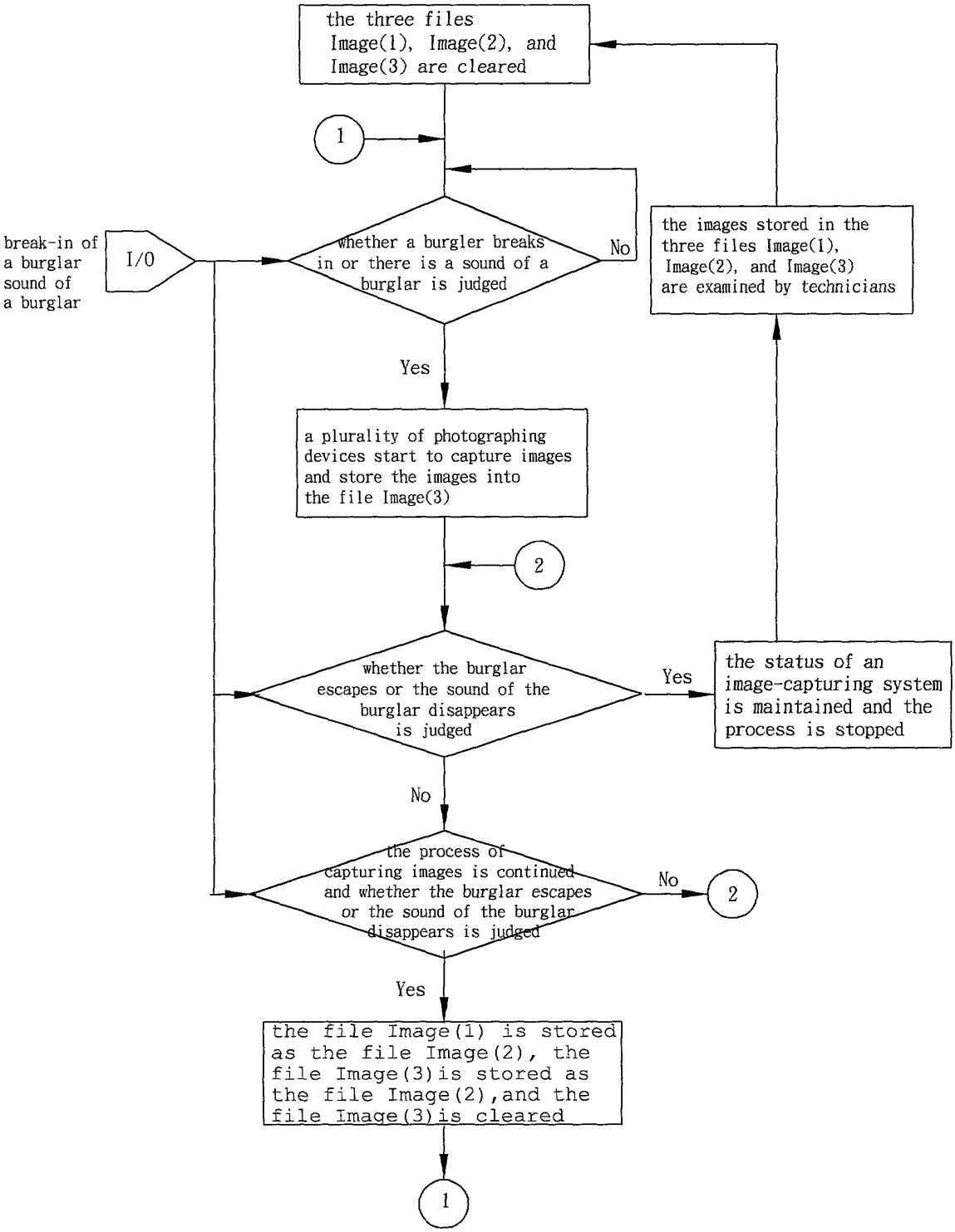

Fig. 5

DECLARATION FOR PATENT APPLICATION

Docket Number Optional)
MR1035-777

As a below named inventor, 1 hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled SMART AUTOMATIC RECORDING SYSTEM AND METHOD FOR MONITORING WAFER FRAGMENTATION, the specification of which is attached hereto unless the following box is checked:

☐ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☒
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐

I hereby claim the benefit under 35 U.S.C § 11 9(e) of any United States provisional application(s) listed below.

_____ (Application Number) _____ (Filing Date)

_____ (Application Number) _____ (Filing Date)

I hereby claim the benefit under 35 U.S.C § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

_____ (Application Number) _____ (Filing Date) _____ *(Status-patented, pending, abandoned)*

_____ (Application Number) _____ (Filing Date) (Status-patented, pending, *abandoned)*

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: MORTON J. ROSENBERG, ESQ., REG. # 26,0491.
DAVID I. KLEIN, ESQ., REG. # 33,253; JUN Y. LEE, ESQ., REG. # 40,262

Address all telephone calls to MORTON J. ROSENBERG at telephone number 410-465-6678

Address all correspondence to ROSENBERG, KLEIN & LEE
3444 ELLICOTT CENTER DRIVE-SUITE 105
ELLICOTT CITY, MD 21043
FAX #: 410-461-3067
E-MAILADDRESS: rkl@rkipatlaw.com

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true., and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor (given name, family name) Ting Kuo CHEN (CHEN IS FAMILY NAME)

Inventor's signature Ting-Kuo Chen Date 9/18/2000

Residence same as post office address Citizenship Taiwan, R.O.C.

Post Office Address 8F-10, No. 819, Sec. 2, Yung Hwa Rd., An Ping Dist., Tainan City, Taiwan, R.O.C.

Full name of second joint inventor, if any (given name, family name) Wen Chin KUO (KUO IS FAMILY NAME)

Second Inventor' signature Wen-Chin Kuo Date 9/18/00

Residence same as post office address Citizenship Taiwan, R.O.C.

Post Office Address No. 5, Alley 32, Lane 91, Hsui Tien St., Hsinchu, Taiwan, R.O.C.

☒ Additional Inventors ate being named on separately numbered sheets attached hereto.

Third Joint Inventor	Yong Sen LIAO (LIAO IS FAMILY NAME)
Inventor's Signature	Yong-Sen Liao — Date 9/18/2000
Residence	same as post office address
Citizenship	Taiwan, R.O.C.
Post Office Address	No. 79, Min-Tzu St., Lin 11, Chu Nan Li, Chu Nan Town, Miao Li Hsien, Taiwan, R.O.C.

Fourth Joint Inventor	Chun Chieh LIN (LIN IS FAMILY NAME)
Inventor's Signature	Chun-Chieh Lin — Date 9/18/2000
Residence	same as post office address
Citizenship	Taiwan, R.O.C.
Post Office Address	NO. 1-8, Lin 5, Shih Ye Village, Chu Chi Hsiang, Chia Yi Hsien, Taiwan, R.O.C.

Fifth Joint Inventor	
Inventor's Signature	Date
Residence	
Citizenship	
Post Office Address	

Sixth Joint Inventor	
Inventor's Signature	Date
Residence	
Citizenship	
Post Office Address	